hot & bothered

Stress is vital for birds' survival during danger. Acute stress triggered by the presence of a predator, for instance, involves rapid physiological changes that prioritise short-term survival through a fight-or-flight response. Once the stressor (in this case, the predator) is no longer present, the stress response tails off and normal physiological functions resume. However, if birds are exposed to persistent, continuous stressors such as human activity, their growth, immune function and reproduction can be severely compromised.

Avian stress is relatively well studied, but one aspect that remains unclear is whether stress responses are triggered by exposure to extremely hot weather. This question is challenging to answer, because catching a bird in order to take a blood sample for measuring stress hormone concentrations is in itself a significant stressor. But the potential link between hot weather and stress is important, as understanding the role of stress is essential for predicting how more frequent and intense heatwaves are affecting birds.

Lesedi Moagi, a BTech student at Tshwane University of Technology in Pretoria, recently examined how daily maximum air temperature affects stress levels in Southern Pied Babblers near Vanzylsrus in the Kalahari Desert. Babblers in this long-term study population are habituated to the presence of researchers, which allowed Lesedi and colleague Amanda Bourne to follow them closely during summer and collect samples of the birds' droppings on days ranging from a mild 28 degrees to a blistering 41 degrees Celsius.

Moving from the Kalahari to the University of Pretoria's Endocrine Research Laboratory, Lesedi then measured the concentrations of biomarker molecules in the babbler droppings. These biomarkers mirror the stress hormones circulating in the birds' bloodstreams, allowing stress levels to be quantified non-invasively. Lesedi's data revealed that on days cooler than 38 degrees, the levels of these biomarkers remained approximately constant. On days when the temperature exceeded 38 degrees, however, biomarker levels increased rapidly. When maximum temperatures approached 41 degrees, biomarker levels were approximately double those on cooler days. For the babblers, hot days are stressful.

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Very hot days are perceived as stressful by Southern Pied Babblers.

The threshold of 38 degrees is significant. Previous studies of the babblers have demonstrated that a host of negative effects, including progressive loss of body mass, reduced rates of food provisioning to nests and declines in breeding success, start occurring in this species when the air temperature reaches 36 to 38 degrees. Lesedi's research confirms that the babblers perceive these days as stressful, findings that represent a significant advance in our understanding of how avian physiology responds to very hot weather. These observations also raise a host of questions about avian susceptibility to heat stress.

A paper in which Lesedi and her co-authors from the universities of Pretoria, Cape Town and Western Australia reported these results was recently published in the *Journal of Experimental Biology*. The editors of the journal were sufficiently impressed by the findings to select this paper as their editors' choice for June 2021.

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Reference

Moagi LL et al. 2021. 'Hot days are associated with short-term adrenocortical responses in a southern African arid-zone passerine bird.' *Journal of Experimental Biology* 224: jeb242535